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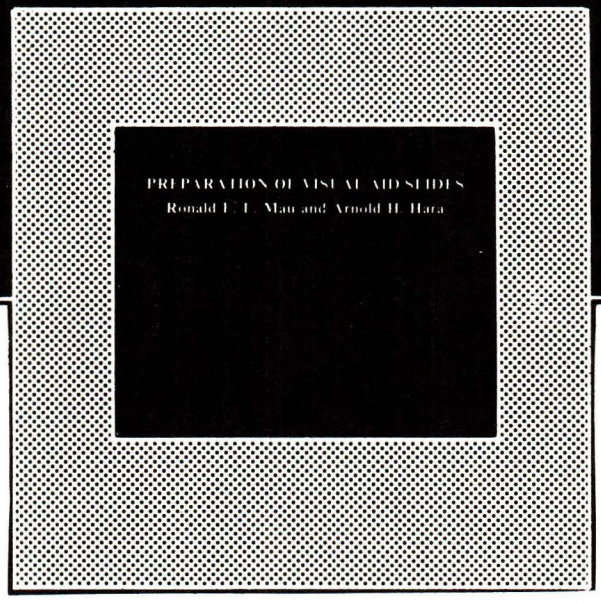
PREPARATION OF VISUAL AID SLIDES

Ronald F. L. Mau and Arnold H. Hara



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THE AUTHORS

Ronald F. L. Mau is Associate Specialist, Department of Entomology, College of Tropical Agriculture and Human Resources, University of hawaii.

Arnold H. Hara Assistant Entomologist,Beaumont Research Center, College of Tropical Agriculture and Human Resources, University of Hawaii.

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Ronald F. L. Mau and Arnold H. Hara
Department of Entomology
University of Hawaii

Several methods of producing high quality slides of titles, graphs, or tables are currently available. Direct copying with color or black and white films, and image-transfer with Diazo® films are methods that have commonly been used, but there are other methods that produce slides of equal or superior quality. This discussion will familiarize the reader with different methods of producing interesting and appealing visual aid slides.

The methods we will describe can be divided into 3 general categories: 1) black and white negative-image slides, 2) black and white positive-image slides, and 3) colored background slides.

In order to produce high-quality slides simply and easily, certain equipment and supplies are necessary. A single lens reflex (SLR) camera equipped with a macro lens or standard lens plus extension tubes or bellows is recommended. The camera must have manual control of aperatures and shutter speeds. Another feature that will help to produce slides more easily is through the lens (TTL) light metering. Many SLR cameras have this feature. Cameras with timed exposure capability in the range of 1-8 seconds are of great convenience when producing slides requiring timed exposures. However, a stop watch and cable-release can be used with cameras lacking this feature.

Photographic copy stands and tungsten photo lamps should be used when possible. The lamps should be positioned on opposite sides of the stand and aimed at a 45 degree angle to the copy surface. Another possibility is using a tripod and attaching the material to be copied on the wall. Paper and lettering should have matte surfaces to eliminate "hot-spot" problems caused by reflections off glossy material.

Kodak® Neutral Test Card (18% reflectance gray) should be used to obtain exposure readings. The card is placed over the material to be copied with the gray surface facing the camera lens. Some methods described below recommend exposure durations measured from the gray surface while others require an additional exposure adjustment. Since incorrect exposure is responsible for many of the poor slides presented by speakers, the suggestions given here should be carefully followed.

Black and White Negative-Image Methods

1. White on Black Background Slides. This type of slide is easily prepared using high contrast black and white negative films and by inserting the processed film in slide mounts. Since an opaque black background is desired, Kodak Technical Pan Film 2415 and Kodak Kodalith Ortho Film 6556 are commonly used. Tech Pan 2415 film is available in 36-exposure magazines or bulk rolls while Kodalith Ortho film is only

available in bulk rolls (50 ft or longer). Both films are easily developed in the laboratory and slides can be prepared in an hour or two.

Exposure of Kodak Technical Pan film should be determined using gray board exposure-readings with the camera set at ASA 100. Additional exposures 1/2 f-stop over and under the gray board exposure are recommended to the desired density. Kodalith Ortho film should be underexposed by 1-1/2 f-stops from a gray board reading when the camera's light meter set at the proper ASA for the developer that is used.

2. Color on Black Background Slides. These slides can easily be prepared by coloring white areas of black background slides with dyes. While many types of colored dyes have been suggested by different authors, we have found Dr. PH. Martin® Synchromatic Transparent Water Colors (Salis International, Hollywood, Florida) and Paper Mate® Flair pens color film emulsions evenly and easily. Dr. PH. Martin No. 32 Cadmium Orange watercolor is excellent for producing title slides and tables.

If the negatives have not been exposed to produce an opaque background, streaks from dye application will appear on the background. Kodalith Ortho 6556 has a really opaque background when exposed correctly and is ideal for this purpose. Follow directions given in the previous section.

Black and White Positive-Image Slides

1. Color Slide Film Method. Positive-image black and white slides are easily prepared from black and white copy using color transparency films. However, exposure determination must be made with the Kodak 18% gray card. If the gray card is not used, slides will be underexposed and difficult to read when projected. A color conversion filter (80A or 80B) is required if daylight films are used with photoflood or tungsten illumination. Color films balanced for photoflood or tungsten illumination are available at most photography shops.

2. Kodak Precision Line Film LPD4. Positive-image black and white slides can be prepared in a few minutes using Kodak Precision Line Film LPD4. This film is only available in bulk rolls so a bulk film loader and reusable film cassettes will be required. This film produces excellent slides of figures from books, typed copy, graphs, and tables and is well worth the inconvenience of processing in your home or laboratory.

The proper exposure for your copying conditions will have to be determined. The LPD4 film requires an exposure of f/3.5 for 2 seconds, with 4 DWC 150W tungsten flood lamps mounted on a Polarid copy stand. Since the photo-designated DWC 150W tungsten flood lamps are expensive and difficult to obtain, Sylvania® 150W tungsten flood lamps may be used.

Kodak S55 developer is used to process the LPD4 film. The ready-to-use developer is available in 5 gallon plastic containers (Kodak Cat. No. 187 2894). No directions are given, but 3-4 minutes is sufficient time to develop the film. The developer can be reused. Use Kodak Fixer or Rapid Fixer to fix the developed film.

3. Direct Positive Development Method. Black and white negative

films may be used to produce positive-image slides by modifying the development process. Directions are provided in Table 1.

Colored Background Slides.

Diazo, blue-toning, and Vericolor slide film methods produce quality colored background slides.

1. Diazo Film Method. The 4 steps are: (1) photographing copy material using Kodak Technical Pan Film 2415 or Kodak Kodalith Ortho Film 6556, (2) processing the film to obtain black and white negatives, (3) exposing sandwiched negative and Diazo film to an ultraviolet light source, and (4) developing the exposed Diazo film in an ammonia chamber. Elder and Agee (1977) give simple instructions for using this method. A slide projector may be substituted for sun (UV) lamps.

Diazo film is available in different colors but is somewhat difficult to obtain locally. Blue, orange-red, violet, and green diazo films are available from Porter's Camera Store, Inc. (P. O. Box 628, Cedar Falls, Iowa 50613). Approximate cost is $4.00 per 50 frames.

One advantage of Diazo film is the ease of preparation from black and white negatives. A distinct disadvantage is the tendency for fading (usually within a few years).

2. Blue Toning Method. In this technique toner solutions are used during film processing. Toning is a chemical process that transforms the normally dark colored emulsions of black and white negative films into transparent colors. Toning requires several extra steps following the standard processing of films. Blue toning is commonly used to prepare slides of tables and figures that are both appealing and easily read by viewers.

This method requires a darkroom, and a film-changing bag or a daylight developing tank such as the JOBO® daylight development tank. Toning chemicals are inexpensive and readily available from biochemical supply firms such as Sigma Chemical Company. Commercially prepared toner solutions such as Berg® Brilliant Blue Toner (Berg Color-Tone, Inc., P. O. Box 16, East Amherst, N. Y. 14051) are usually not available locally but can be ordered. Use of commercially prepared toners will increase processing costs considerably.

Graphs, tables, or titles are copied using Kodak Technical Pan Film 2415 or Kodak Kodalith Ortho Film 6556. It is important to underexpose the Tech Pan film by 1 to 2 f-stops or Kodalith by 1-1/2 to 2 f-stops from the exposure reading obtained with a 18% gray board.

An alternative and easier method is to use Kodak Technical Pan Film 2415 with the camera meter set ASA 80 and make normal exposures from material to be copied instead of using the gray board. The change of film speed (ASA) automatically makes the required degree of underexposure. Very consistent results are possible using cameras with electronically controlled shutters.

A list of materials that are needed is presented in Table 2. The

processing and toning procedure in Table 3 is a modification of Hafetz (1977). A diagnostic guide to problems encountered in blue toning is provided in Table 4. Despite the few problems that can occur, this method provides procrastinators with a method that produces slides within an hour or two. This method is also convenient for scientists in small towns with poor photographic services.

3. Vericolor Slide Film Method. High quality color background slides are easily produced using Kodak Vericolor Slide Film 5072. This film makes it possible to produce visual-aid slides merely by photographing black and white copy material using certain color filters and tungsten lights.

Blue background slides are prepared by using a yellow filter (Wratten No. 12), cyan backgrounds using a red (Wratten No. 29) filter, green backgrounds using a deep magenta filter (Wratten No. 34A), and red backgrounds using a light blue (Wratten No. 38) filter.

Vericolor slide film 5079 is available in 100 ft. bulk rolls (Cat. No. 1221217) or in 135 magazines (Kodak Vericolor Slide Film SO-279, Cat. No. 162 2364). The film can be processed by Kodak or any other laboratory that uses C-41 process.

Although exposure times will differ slightly according to your copy set up, Table 5 provides exposure times based on 4 150W tungsten flood lamps. Calibrate your copy set-up by bracketing in 1/2 f-stop increments above and below the values provided in the table. You will be very pleased with the results.

References Cited

Elder, H. W. and H. R. Agee. 1977. A simple and inexpensive method for preparing slides using diazo film. Bull. Entomol. Soc. Am. 23:119.

Hafetz, A. 1977. Preparation of blue background slides. Bull. Entomol. Soc. Am. 23:256.

TABLE 1. DIRECT POSITIVE DEVELOPMENT USING BLACK AND WHITE NEGATIVE FILMS

Films: Kodak High Contrast Copy (ASA 16-32)
Kodak Direct Positive Panchromatic Film 5246 (ASA 64)
Kodak Panatomic-X Film (ASA 64)

Chemicals:		
	1st Developer	- 89 ml Ektaflow Developer (Type 1) 2.5 grams KSCN in 384 ml water
	Re-Developer	- 89 ml Ektaflow Developer (Type 1) in 384 ml water
	Bleach	- 5 grams $K_2Cr_2O_7$, 5ml conc. H_2SO_4 in 1 liter water.
	Clear	- 50 grams Na_2SO_3 in 1 liter water
	Fixer	- Kodak Rapid Fix

Procedure:		
	1st developer	- 3 min (agitate for 5 sec. every 30 sec)
	Wash	- 2 min.
	Bleach	- 1 min.
	Wash	- 1 min.
	Clear	- 2 min.
	Re-expose	- 2 min. (75W bulb at 10-15 cm)
	Re-develop	- 3 min.
	Wash	- 30 sec.
	Fix	- 1 min.
	Wash	- 30 sec.
	Hypoclear	- 2 min.
	Wash	- 5 min.
	Photoflo	- dip
	Dry	

Procedure courtesy of Dr. Jeri Ooka, U.H. Plant Pathology Dept.

TABLE 2. SUPPLIES AND EQUIPMENT FOR MODIFIED HAFETZ BLUE TONING

1. Film and Processing Chemicals

   Technical Pan Film 2415
   Kodak D-19 Developer
   Kodak Rapid Fixer with hardener
   Kodak Hypo Clearing Agent
   Kodak Indicator Stop Bath
   Kodak Photo Flo

2. Toning Chemicals

   Potassium ferricyanide (Sigma No. P-8131)
   Ferric ammonium citrate, brown (Sigma No. F-5879)
   Oxalic acid (Sigma No. 0-0376)
   Sodium metabisulfide (Sigma No. S-9000)

3. Equipment

   Photographic copy stand
   Tungsten flood lamps (2-4)
   Single lens reflex camera with 50-55 mm macro lens
   Film developing tank (i.e. JOBO 2400 daylight developing tank)

4. Preparation of Processing Chemicals

   Prepare processing chemicals according to instructions by the manufacturer. Be sure to place date of preparation labels on each container since processing chemicals are good only for a specified period.

5. Preparation of Toning Chemicals

   Prepare the toning chemicals according to the following formulae. Toning solution A is light sensitive and should be stored in amber plastic bottles.

Toner Solution A:	Oxalic acid.....	2.0 g
	Potassium ferricyanide....	2.0 g
	Ferric ammonium citrate...	2.1 g
	Water.....	500 ml
Toner Solution B:	Sodium metabisulfide.....	2.0 g
	Water.....	500 ml

TABLE 3. PROCESSING AND TONING PROCEDURE FOR MODIFIED HAFETZ METHOD

1.	Load film into a developing tank such as JOBO Daylight Loading Film Tank. The JOBO tank is preferred because of the thorough washing that is possible, but any tank that allows for thorough washing is suitable.	
2.	Develop in D-19 Developer at 20°C (68°F) with agitation at 30 sec intervals.....	**4 min**
3.	Pour out developer and rinse with indicator stop bath at 18.5 to 21°C (65°-70°F). Agitate during the rinse.....	**30 sec**
4.	Fix with Kodak Rapid Fixer (without hardener) at 18.5°to 21°C (65°-70°F) and save the fixer for use after toning. Agitate at 30 sec intervals.....	**2 min**
5.	Wash with hypoclearing agent. Agitate during the washing period.....	**30 sec**
6.	Wash the film with running water.....	**10 min**
7.	Add Toner A and agitate at 30 sec intervals.....	**6-8 min**
8.	Wash the film with running water as in No. 6.....	**10 min**
9.	Clear with Toner B. Agitate at 30 sec intervals.....	**1 min**
10.	Wash with running water as in No. 6.....	**10 min**
11.	Fix with Kodak Rapid Fixer with hardener. Add 13 ml hardener to the 500 cc fixer used in step No. 4. Agitate at 30 sec intervals.....	**1 min**
12.	Wash with hypoclearing agent. Agitate during wash.....	**30 sec**
13.	Wash with running water.....	**5 min**
14.	Dip in photoflo and dry. Blue hue darkens significantly within 24 hours.	

TABLE 4. DIAGNOSTIC GUIDE TO SOME PROBLEMS ENCOUNTERED IN PREPARING BLUE TONED SLIDES USING THE MODIFIED HAFETZ METHOD

Problem	Probable Cause	Solution
Background is black or dark blue	Incorrect exposure of film during copying	Underexpose further by 1/2 to 1 f-stop
	Toning solution A not aged	Age for 8 hours
	Toning solutions too old	Prepare new toning solutions
Lettering or graphs are blue	Insufficient under-exposure	Underexpose further in 1/2 f-stop increments.
		Poor typed original
Background is light blue	Excessive under-exposure	Increase exposure by 1/2 to 1 f-stop
	Poor washing after 1st fixing step	Follow instructions more carefully
	Unknown	Allow film to stand for 24 hours
Streaking in blue background	Poor washing	Improve circulation of water during washing
Background cloudy after completion of toning process	Unknown	Hang to dry; film will become darker within a few hours

TABLE 5. VERICOLOR SLIDE FILM. SUGGESTED FILTERS AND EXPOSURE TIMES

Background Color	Wratten Filter No.	F-stop and Exposure
Cyan	29 (red)	f/8 at 4 sec
Dark Blue	12 (yellow)	f/11 at 4 sec
Green	34A (magenta)	f/8 at 4 sec
Red	38 (light blue)	f/11 at 4 sec
Orange	44 (cyan)	f/11 at 4 sec

The exposure settings are for a 55 mm macro lens and a copy stand which has 4 150W tungsten flood lamps.

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